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THE MOVEMENTS OF THE HIGH CLOUDS IN THE WEST INDIES.

By JOHN T. QUINN, Esq., St. Kitts, W. I., dated May 24, 1904.

There was printed on the back of the Pilot Chart of the North Atlantic for August, 1902, a valuable paper on West Indian hurricanes, in the fourth column of which, in a passage describing the normal weather conditions within the Tropics, it is stated that, "The higher clouds (cirrus, cirro-cumulus) come in general from some point between north and east, the lower clouds (cumulus, cumulo-nimbus) from a point between east and south."

Having always believed that the "return trade wind," at least from Maury's time onward, had been universally accepted as a part of the ABC of tropical meteorology, I was very much surprised by the first part of the above statement, namely, that the higher clouds come in general from some point between north and east. The evidence for the generally accepted statement, that the high clouds in the West Indies move as a rule from some westerly point, seemed to be so conclusive that it was natural to assume that the statement in the article printed on the Pilot Chart must be a slip of some sort. But as it appears again in a reprint of the paper in question on the back of the Pilot Chart of the North Atlantic for September, 1903, it is perhaps not a slip after all; but in that case it would be interesting to know where the observations on which the statement is based were made, for it does not appear to be correct for the smaller islands of the West Indies or for the stretch of ocean that lies immediately in front of them.

From the following table it will be seen that out of 58 observations only 15 showed high clouds moving from a point in the northeast quadrant, and, as will appear later, some of these can be shown to be dependent on cyclonic movements, which have caused a deviation from the usual direction. It will also be seen that after entering as belonging to the northeast quadrant the 4 observations of clouds moving from the north there are still only 15 entries in that quadrant, while there are 30 entries in the northwest quadrant. If, therefore, we were to write in the passage quoted from the Pilot Chart the words "between north and *west*," instead of the words "between north and *east*," the statement would come much nearer to the truth, so far, at least, as the smaller islands of the West Indies are concerned. Still nearer the truth would it be to say that the high clouds come from some westerly point, for we see that out of the total of 58 entries 39 are in the western semicircle, while 19 only are in the eastern semicircle, and if the 4 entries of movements from the north were divided between the two semicircles, instead of being all put in the eastern semicircle, as they are in the table, then the relation would be 41 to 17.

As bearing on this question I have collected and arranged in the following table my observations of the movements of the high clouds, as observed from one or the other of the Danish Islands of St. Croix and St. Thomas (mostly from the former), during the months from July to November last year:

Date.	Clouds.	Direction.			
		From a point in the western semicircle.		From a point in the eastern semicircle.	
		NW. quadrant.	SW. quadrant.	SE. quadrant.	NE. quadrant.
1903.					
July 19	Cirrus	wnw.			
July 30	do	w.			
Aug. 1	do			se. or se. by e.	
Aug. 2	do			se.	
Aug. 4	do				n.
Aug. 17	do				n. by e.
Aug. 18	do				n. by e.
Aug. 23	do	w.			
Aug. 25	Cirro-stratus			ese.	
	Cirrus			e. or e. by s.	
Aug. 26	do		sw. or ssw.		
Aug. 30	Cirro-stratus	w.			
Aug. 31	Cirrus				e.
Sept. 1	do		sw.		
Sept. 5	Cirro-stratus		sw.		
Sept. 6	do		sw.		
Sept. 8	do		wsw.		
Sept. 10	Cirrus		sw.		
Sept. 11	Cirro-stratus		sw. or sw. by s		
Sept. 13	Cirrus		sw.		
Sept. 14	Cirro-stratus	nnw.			
Sept. 18	do	nw.			
Sept. 20	Cirrus				e.
Sept. 25	10 a. m. do	w.			
	3 p. m. do				e.
Oct. 1	a. m. do	nw.			
	p. m. do	nw. or nnw.			
Oct. 3	do	nw. or nnw.			
Oct. 4	do	w.			
Oct. 6	do				ene.
Oct. 7	do				ne.
Oct. 8	7 a. m. do				nne.
	2:30 p. m. do				n.
Oct. 9	Cirro-stratus	nw.			
Oct. 11	Cirrus	wnw.			
Oct. 13	do	w.			
Oct. 14	a. m. Cirro-stratus	wnw.			
	p. m. Cirrus	wnw.			
Oct. 15	do	wnw.			
Oct. 20	do	w.			
Oct. 21	Cirro-cumulus		s. or s. by w.		
Oct. 23	Cirro-stratus and cirrus.	w.			
Oct. 24	do	w.			
Oct. 25	Cirrus				ene. or ne.
Oct. 27	Cirro-stratus				n.
Oct. 28	do				nne.
Nov. 2	Cirrus				nne.
Nov. 3	do				n.
Nov. 4	do	nw. or wnw.			
Nov. 5	Cirro-stratus	wnw.			
Nov. 11	do	nw.			
Nov. 13	Cirrus	wnw.			
Nov. 14	Cirro-stratus	w.			
Nov. 15	do	w.			
Nov. 19	do	wnw.			
Nov. 20	do	wnw.			
Nov. 21	Cirrus and cirro-stratus.	w.			
Nov. 22	Cirrus, cirro-stratus, and cirro-cumulus.	w. by s.			
Total		30	9	4	15

It appears, then, that the westerly directions are the normal and the easterly the exceptions; and if the conditions over the surrounding ocean at the time were known, these exceptional cases might perhaps be all explained. For two of them, embracing 5 out of the 19 observations, it does, indeed, seem highly probable that the exceptional conditions causing the movements were revealed by the movements themselves, as shall now be noted.

It may perhaps be taken for granted that the theory of the spreading of the upper air from the vortex of a cyclone is now commonly accepted, and if the facts correspond with the

theory then the motions of the high clouds, after allowing for the effect of the earth's rotation and the forward motion of the storm, ought to point out approximately where the vortex is, and I think that in the two instances just referred to it can be shown that such was actually the case. The first of these two instances is in connection with the entries in the above table under date of the 25th of September. In the morning of that day, in St. Thomas, a few small cirrus clouds were seen to be moving with extreme slowness from the west or thereabout; at midday very careful observations could detect no motion in them; but further observations in the afternoon, several times repeated, showed that they were then moving very slowly from the east. This reversal of the motion of the high atmosphere suggested the appearance on the scene of a cyclone, say at a distance of some 500 or 600 miles eastward of St. Thomas, or more correctly, perhaps, northeast of St. Thomas. To a brother amateur I remarked that we must now watch our barometers, but the barometers gave no sign. Crossing the channel to St. Croix the same night, however, I found a considerable swell coming down the Anegada Channel from the northeast, and on arriving at Christiansted the next morning saw this swell surging on the "Long Reef" there. It had been surging in that way from the previous afternoon, and it continued through Saturday the 26th and Saturday night, but by Sunday morning was much reduced. This behavior of the sea confirmed the suspicion, raised by the reversal of the movement of the high air, that a cyclone, having its center far away to the northeast, had passed in front of the Anegada Channel. Such a cyclone would also pass along toward the northwest on the north side of the Virgin Islands; but no confirmation of these views was then obtainable. Twenty days later, however, the barque *Carioca* put into St. Thomas in distress, and reported having been dismasted in a hurricane blowing from northeast at 5 p. m. on Sunday, the 27th of September, the vessel being then about 200 miles south of Bermuda; also that the calm center of the hurricane had passed over her at 9 o'clock that evening. Later, it became known that a hurricane had passed over Bermuda the following day, the center, which was then moving toward the northeast, passing over the islands at about 1 p. m. There can hardly be a doubt that these two reports refer to the same storm, and it appears to be extremely probable that it was the same storm whose approach from eastward caused the reversal in the movement of the higher air over St. Thomas on the 25th, and which sent the heavy swell down the Anegada Channel to beat on our "Long Reef" at Christiansted.

The second of the two cases referred to is in connection with the observations noted in the foregoing table on the 6th, 7th, and 8th of October. It will be seen from the table that the high clouds on those days came, successively, from east-northeast, northeast, north-northeast, and north. According to the statement quoted from the Pilot Chart, these directions were usual, but according to the view taken in the present article they were *exceptional* and indicated the passage of a cyclonic disturbance north of these Danish Islands, and moving from an easterly to a westerly point. The earliest evidence of this disturbance was noticed on the afternoon of Tuesday, the 6th of October, when a light surf appeared on the "Long Reef" at Christiansted. This rapidly increased in force, and by 8 o'clock in the evening, which was calm, the roaring of the reef became very marked. All through the night the sound increased, and on the morning of Wednesday (the 7th) magnificent billows were seen breaking, one after the other, into successive lines of white foam running along the reef. The night had been very fine, with a well-advanced moon shining, and this gave the opportunity for noting that the sky was covered with cirro-stratus and cirrus clouds, moving very slowly from east-northeast. On Wednesday morning (about 8 o'clock) some well-defined cirrus streaks were seen moving from about north-east at a faster rate than that of the high clouds seen during the night. By Thursday morning (the 8th) the cirrus clouds were coming from north-northeast, and by 2:30 p. m. on the same day they were coming from north. On Thursday a moderate swell was running on the shore at Fredericksted (west end of St. Croix), showing that the storm center was then north or northwest of the Culebra Channel. On Friday morning the sea at Fredericksted was smooth, showing that the center had by that time moved far away. The obvious theoretical explanation of these facts is that a cyclone, moving from east to west, had passed to the north of the Virgin Islands; but no direct confirmation was obtainable, or, indeed, has since come to hand. We learned a few days later, however, of the heavy weather off the coast of the Southern States on Friday, the 9th, and Saturday, the 10th, and it seems reasonable to suppose that this weather was only a subsequent part of the effect of the movement revealed here by the heavy sea and the successive directions of the high clouds, sweeping around, as they did, from east-northeast to north, and, finally, through northwest to west.

The above two cases seem to show for 5 out of the 15 observations of high clouds coming from points in the northeast quadrant that they were exceptional; of the remaining 10 I am not able to offer any explanation, neither can I give any account of the meaning of the 4 observations made in August of high clouds moving from points within the southeast quadrant. The latter observations appeared to indicate danger for some of our islands, but no disturbance followed them, either among the islands or in the neighboring waters, so far as is known here. A wider knowledge of the facts might perhaps explain these observations, and of course there is always the chance of error in the observations themselves; but at all events the table shows double the number of movements from points in the western semicircle as compared with the eastern semicircle, and of the latter, 5 can be shown to be exceptional.

It appears, then, that there is good reason for regarding the movement from a point within the western semicircle as the usual movement of the high clouds in this part of the world, and any movement from a point in the eastern semicircle as exceptional, and therefore as calling for watchful observation. For navigators of these waters and for us of the West Indies, whose island homes lie like ships anchored in the tropical sea, it is of some consequence to be correctly informed on such points, and this fact may perhaps be admitted as a sufficient justification for the present article.

Although the preceding criticism by Mr. Quinn would appear to be well founded, in consideration of the general belief that the lower trade wind is from the east and the upper return trade from the west or southwest, yet there is much data on hand to support the original statement in the Pilot Chart, and the matter really requires elucidation by careful observation with the marine nephoscope. When at sea one must necessarily observe directly the apparent movement of the clouds relative to the motion of the observer. Navigators are expected to make some allowance for the latter, and to record the true movement as referred to either the true or the magnetic meridian. But this true movement is by them deduced from the apparent observed movement by a process of estimation that is really quite empirical and may often be entirely erroneous. For instance, the motion of a vessel going southward, or from the north, introduces an apparent northward component into the movement of the clouds. If the cloud is really moving from the west then its apparent motion is from the southwest. The difference between the true and apparent motion depends upon the velocity in miles per hour of the vessel and the cloud, respectively, and on the height of the cloud above the sea if we observe with the nephoscope, but on the distance of the cloud from the observer if we depend on the

unaided eye. There is therefore abundant room for a large variation in the navigator's estimate of the motion of the cloud.

The editor of the Pilot Chart says:

The statement to which Mr. Quinn calls attention was made with full knowledge that it was in opposition to the generally accepted theories of an eastward drift at high altitudes in the Tropics. It is, however, in accordance with the observations upon which the major portion of my hurricane article is based, namely the Greenwich mean noon observations returned by the voluntary meteorological observers afloat and cooperating with this office. These agree in showing that in the vicinity of the West Indies and during the hurricane season the motion of *what they call the upper clouds* is from a point between north and east, while the motion of *what they call the lower clouds* is from a point between south and east. It may be that the navigators did not properly distinguish between upper and lower clouds, or that they, on rapidly moving vessels, were unable to detect the slow eastward drift of the lofty cirrus. But inasmuch as my article was written for their benefit, and with the hope that it might prove of practical value to these observers in time of need, it seemed wise to adopt their system of classification and to present the phenomena as they appeared to, and were recorded by, the men for whom I was writing. It did not seem wise to attempt to explain to them that what they were in the habit of calling upper clouds were not upper clouds at all, or that the motion which they had recorded as taking place from the east was really in the opposite direction. It would probably have been safer to have based my statements upon the facts recorded by trained observers at regular meteorological stations. I may do this in future editions of the article, and at the same time request the mariner to see and record the facts as they really are rather than as they appear to be. Definite instructions to the voluntary meteorological observers at sea were first issued in 1901, prior to which time, and in some cases subsequently thereto, the cloud observations were signally lacking in accuracy.

My own analysis of the frequency of cloud motions during hurricane months, as observed at Belen College, Havana, gives the following figures:

Clouds.	Number of observations.	Percentage of frequency of movement from—			
		NE.	SE.	SW.	NW.
Upper.....	645	23	8	39	30
Lower.....	650	44	34	15	7

Mr. Page's analysis of the Havana observations shows that there is a very respectable percentage of upper cloud movements from the east. The extensive studies made by Professor Bigelow (see MONTHLY WEATHER REVIEW for April, 1904) show that great variations occur in the level that separates the upper westerly from the lower easterly movement. It may be quite possible that observers, both on land and sea, are unable to distinguish the altitude of a cloud by means of its appearance, and that so-called cirrus clouds are below the normal altitude as frequently as they are above it. It may be that cirrus clouds actually occur in the lower stratum as well as in the upper. The Editor observed continuously with his marine nephoscope on the island of Barbados and in its vicinity, during the cruise of the *Pensacola* in February, 1890, and found true cirrus clouds moving in a variety of directions between northwest and southwest and with a great variety of velocities. We should never forget that cirri and cirro-cumuli often form at the boundary between two layers of wind; the movement of the cloud is the resultant of the action of the two winds, and does not represent the actual motion of either nor the motion of any very important thick layer of air. The clouds simply move within the thin layer of mixture that separates the two more important masses.

Again, there can be no doubt that ascending masses of northeast trade wind and descending masses of southwest return trade frequently come into contact or collision, especially during the warmer part of the day, each obstructing the other's progress. As we approach the equator all trade-wind motion from the northeast gradually dies away. It can, therefore, happen that at points considerably removed from the equator the obstructed winds, rising and carrying their clouds with them, may produce the phenomenon of cirrus clouds from the northeast, while below these the descending winds may carry light cirrus clouds from the west. It seems likely that this phenomenon would occur most frequently on the northerly border of the track of a hurricane.

The more we consider the question here under discussion, the more convinced we must be of the great importance of improving and extending the methods and observations of the whole system of cloud observations on land and on sea.—*C. A.*

THE DISSEMINATION OF DAILY FORECASTS BY TELEPHONE.

By WM. G. BURNS, Section Director, Springfield, Ill., dated June 27, 1904.

The rapid development of telephone service in the Middle West, especially in the rural communities, has opened up a great field for the dissemination of the daily weather forecasts. This effective means was recognized over a year ago, and attention was invited to the fact in the Annual Report of the Illinois Section for the year ending June 30, 1903. While the development of the service in this section does not yet show altogether satisfactory results, arrangements are now under consideration whereby it is believed the information will be made available for 250,000, or more, telephone subscribers in small towns and rural districts.

The census of 1900 has credited Illinois with 264,000 farms, fully one-half of which, it is believed, are now supplied with telephones. The work of building new lines and connecting the different exchanges is rapidly progressing, and information has been received that one telephone supply house alone is furnishing new material in that direction at the rate of $500,000 a year.

A convention of State telephone managers was recently held in Springfield, Ill., and opportunity was afforded to address the body on the subject of cooperation. It was represented that all progressive exchanges maintained an information operator, and as the weather and its changes formed a vital subject of interest to the rural communities, the information operator would not be well equipped without this intelligence. It was further stated that in extending the telephone service the fact that the weather information would become available to its subscribers, would often be the determining factor in inducing an irresolute farmer to enroll. The facts presented were well received and active cooperation was promised. It has been planned to offer the service to telephone exchanges, and then notify the public through the press that the information is available.

Under the growing operation of connecting the exchanges into one vast homogeneous system, it will not be necessary to send telegrams to all, but, by careful selection of well located centers, a large territory may be covered by relaying the information from one exchange to another.

The following extract from the Copper Country News, Calumet, Mich., of June 21, 1904, shows that the plan which Mr. Burns advocates in Illinois has been approved in Ohio and Kentucky.

The extent to which the Weather Bureau is appreciated and utilized by the farmer is exemplified by the fact that the Cincinnati and Suburban Telephone Company has made an arrangement with the Weather Bureau in Cincinnati by which the farmers in surrounding counties in Ohio and Kentucky are enabled to get the daily morning forecast of the weather almost as soon as it is made.

The plan is to have the forecast telephoned immediately after its making to the central exchange in Cincinnati, which in turn will telephone it to the local exchanges in eight counties. These are to give out the information to the patrons in those places free of charge.

ATTEMPTS AT METHODICAL FORECASTING OF THE WEATHER.[1]

By LOUIS BESSON.

[Translated by Miss R. A. Edwards.]

At the present time scientific forecasting of the weather is

[1] Annuaire de la Société Météorologique de France, April, 1904, pp. 92–97.